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Impact of opioid substitution therapy for Scotland's prisoners on drug-related deaths soon after prisoner release

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ABSTRACT

Aim To assess whether the introduction of a prison-based opioid substitution therapy (OST) policy was associated with a reduction in drug-related deaths (DRD) within 14 days after prison release. **Design** Linkage of Scotland's prisoner database with death registrations to compare periods before (1996–2002) and after (2003–07) prison-based OST was introduced. **Setting** All Scottish prisons. **Participants** People released from prison between 1 January 1996 and 8 October 2007 following an imprisonment of at least 14 days and at least 14 weeks after the preceding qualifying release. **Measurements** Risk of DRD in the 12 weeks following release; percentage of these DRDs which occurred during the first 14 days. **Findings** Before prison-based OST (1996–2002), 305 DRDs occurred in the 12 weeks after 80 200 qualifying releases, 3.8 per 1000 releases [95% confidence interval (CI) = 3.4–4.2]; of these, 175 (57%) occurred in the first 14 days. After the introduction of prison-based OST (2003–07), 154 DRDs occurred in the 12 weeks after 70 317 qualifying releases, a significantly reduced rate of 2.2 per 1000 releases (95% CI = 1.8–2.5). However, there was no change in the proportion which occurred in the first 14 days, either for all DRDs (87: 56%) or for opioid-related DRDs. **Conclusions** Following the introduction of a prison-based opioid substitution therapy (OST) policy in Scotland, the rate of drug-related deaths in the 12 weeks following release fell by two-fifths. However, the proportion of deaths that occurred in the first 14 days did not change appreciably, suggesting that in-prison OST does not reduce early deaths after release.

Keywords Drugs-related deaths, release from prison, risk-reduction, opioid substitution therapy, opioid-related deaths.

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INTRODUCTION

It is recognized both in the United Kingdom [1–3] and internationally [4] that recently released prisoners, notably those with a history of having injected heroin, are at very high risk of drug-related death (DRD). This increased risk is concentrated in the first 2 weeks after release from prison. For example, Seaman *et al.* [1] reported that male HIV-infected drug injectors released from Edinburgh Prison during 1983–94 had a relative risk (RR) of DRD of 8 [95% confidence interval (CI) = 1.5–39] during the first 2 weeks after release versus other comparable times at liberty. Bird & Hutchinson found that males aged 15–35 years had a DRD risk seven times (95% CI = 3.3–16) higher in the first than per 2 weeks in the subsequent 10 weeks [2]. Further, 60% of DRDs within 12 weeks of release had occurred within the first 2 weeks. These findings have since been confirmed in record-linkage studies in England and

Wales [3], Australia [5] and the United States [4]. Subsequently, there have been other studies of DRDs soon after release from Asia, northern Europe and the United States [6–10].

The loss of opiate tolerance while in prison may lead to fatal overdose if opiate use is resumed after release from prison. Opiate substitution therapy (OST) aims to reduce the use of illegal and injected opiates by providing safer substitutes such as oral methadone. Provision of OST in prisons, besides being good clinical practice, seems to have contributed to a reduction of in-prison deaths [11], including suicides by younger inmates [12] and of injecting while in prison, with its attendant risks of blood-borne virus transmission [13–17]. Another possible benefit of prison-based OST might be to prevent the loss of opiate tolerance and so reduce the risk of DRD after release. Theoretically, this impact is likely to be greatest in the early period after release, particularly the first

2 weeks, as after this time continued opiate use is likely to lead to opiate tolerance being re-acquired. However, the extent to which prison-based OST has actually reduced these early risks is an open question. In New South Wales (NSW), prison-based OST was introduced in the late 1980s [5], but Merrill *et al.* found that the RR for DRD in the first 2 weeks after prisoner release actually rose, from 4.0 (95% CI = 3.3–4.8) in 1988–92 to 5.1 (95% CI = 3.8–6.9) in 1998–2002 [4].

Despite NSW's long-established policy of prison-based OST, Degenhardt *et al.* [18] reported that the proportion of 12-week DRDs that occurred in the first 2 weeks was approximately 50% in 2000–10, unchanged from 1988 to 2002 [4,5], although prison-based OST had been received in 58% of opiate-dependent clients' prison episodes.

We are not aware that any prison jurisdictions, other than NSW [4,5,18], have monitored the impact of prison-based OST on DRD risk soon after prison release. When Stallwitz & Stover summarized the published literature on the impact of OST in prisons, neither reduction of in-prison mortality nor reduction in early post-release risk of DRD was among the specified goals [19].

In summary, no before-and-after evaluation of how prison-based OST policy impacts on DRDs soon after release has been published. Instead, analysts have focused only on those who did or did not receive prison-based OST when on offer [18]. We therefore aimed to discover whether a policy of prison-based OST was associated with a reduction in early DRD risk, specifically during the first 2 weeks after prison release.

The Scottish Prison Service introduced OST in Scottish prisons in 2002 [20]. Opiate users who report that they had been receiving methadone maintenance therapy prior to prison entry and who also have a positive urine test for methadone are eligible for the programme. Treatment consists of daily oral doses of methadone administered under supervision throughout the prison stay. In a small number of cases, buprenorphine is used instead of methadone. Opiate users who had not been receiving methadone prior to prison entry receive detoxification treatment. Prison-based OST was implemented rapidly in Scottish prisons, with 14% of all prisoners receiving methadone in 2003 and 21% by 2010 [21,22]. Taylor *et al.* reported that, in 2010, 57% of Scotland's prisoners with a history of injection drug use were receiving OST, a level similar to that reported in NSW [18].

We investigated whether the risk of DRD within the first 12 weeks after prison release fell between 1996–2002 (before Scotland's prison-based OST programme) and 2003–07 (after its introduction), and whether an in-prison OST policy was associated with a fall in the proportion of 12-week DRDs occurring in the first 2 weeks.

METHODS

Graham and colleagues [23] linked the records of all those in Scottish prison custody between 1 January 1996 and 31 December 2007 to routine death registrations, generating a retrospective cohort study that provided cause-specific information on deaths up to 31 December 2007. Follow-up information was based on death registration [24]; where there was no such registration, the individual was assumed to be alive. As our investigation was not one of the original objectives of the Graham study, a variation on permissions was approved by Scottish Prison Service's Research Access and Ethics Committee and by Scotland's Privacy Advisory Committee.

Statistical methods

We restricted our study to qualifying releases, which were defined as: 'release on or after 1 January 1996 (and up to 8 October 2007) that occurred after an imprisonment of at least 14 days and at least 14 weeks after the date of the preceding qualifying release'. The restriction to 8 October 2007 was to allow a 12-week mortality follow-up for all releases in 2007, as mortality data were available only up to 31 December 2007. The restriction to releases at least 14 weeks after a previous release allowed for 12 weeks' follow-up for mortality after the preceding release, as in previous studies [2,25], plus 2 weeks as minimal length of imprisonment before the next qualifying release. We excluded imprisonments of less than 14 days on the grounds that these were too short to lead to loss of opiate tolerance.

Our power calculation assumed that prior to OST introduction (in 1996–2002), 60% of DRDs within 12 weeks after release would occur in the first 2 weeks, as reported previously in Scotland [2], and that after the introduction of OST this would fall to approximately 47%, the figure observed in NSW when OST was widely used [4,5]. To detect such a change, the comparison periods would each have to contribute approximately 230 DRDs in the 12 weeks after qualifying releases for 80% power at the 5% significance level.

From the linked prisoner-mortality database held at Information Services Division, Scotland, we calculated the number of deaths that occurred at liberty among ex-prisoners in the 12 weeks after the prisoners' qualifying for prison release, by age group at release (15–34 years and 35+ years) and for the periods before and after the introduction of prison-based OST. Our assignment of exposure to in-prison OST was therefore based on whether the prisoner was released before the introduction of prison OST in Scotland (1996–2002) or during a period (2003–07) when the use of OST was widespread, as confirmed by the previously cited surveys [13,21,22].

Deaths were analysed for two periods before the introduction of OST (1996–99 and 2000–02) and for two periods after (2003–05 and 2006–07). We excluded any in-prison death which coincided with the deceased's liberation date and was not recorded as having occurred in the outside community. We defined deaths as DRDs using the wide definition of the Office for National Statistics, which includes deaths where the underlying cause is coded to the following International Disease Classification (ICD) codes: 292, 304, 305.2–9, E850–858, E950.0–5, E962.0 and E980.0–5 (ICD-9 for 1996–99) or F11–F16, F18, F19, X40–X44, X60–X64 and Y10–Y14 (ICD-10 from 2000). Full description of these codes is given in the Supporting Information. We calculated the number of 12-week DRDs that occurred in the first 2 weeks after the qualifying prison release and the risk of DRD in the 12 weeks post-release (per 1000 qualifying releases; and per 100 person-years at risk, which takes follow-up time and re-imprisonment into account). We calculated person-days at liberty in the first 12 weeks after a qualifying release from the day of release up to the earliest of: date of death, date of re-incarceration for at least 14 days or 12 weeks after the qualifying release date.

We used the first 2 weeks and 12-week DRD totals for 1996–2002 and 2003–07 to compare the percentage of 12-week DRDs that had occurred in the first 2 weeks post-release before and after the introduction of Scottish prisons' OST policy.

In addition, we calculated the number of opioid-related DRDs in the first 2 weeks and 12 weeks after qualifying releases for 2000–02 and 2003–07. Data on whether or not DRDs were opioid-related were not available prior to 2000. DRDs were defined as opioid-related when toxicological information indicated that any of heroin, morphine, methadone or buprenorphine was implicated in, or had contributed to, the cause of death. Data extraction was

programmed using Stata version 13 (College Station, TX, USA). Comparisons were made using χ^2 tests and 95% confidence intervals are Poisson-based.

RESULTS

The study included 150 517 prison releases (for 131 472 individuals) between 1 January 1996 and 31 December 2007, 10 085 (7%) of which were among females. There were approximately 11 450 qualifying releases per annum during 1996–02 and 16 250 per annum in 2006–07 (Table 1). DRDs accounted for 70% (95% CI = 66–74%) of all deaths in the 12 weeks after prison release in the younger age group but only 32% (95% CI = 27–37%) of those aged 35 years or older.

For all ages combined, the DRD rate in the 12 weeks after prison release fell from 3.7 and 4.0 per 1000 qualifying releases during two periods before the OST policy to 2.4 and 1.9 during two periods after (Table 2). Overall, the 12-week DRD rates per 1000 qualifying releases fell from 3.8 (95% CI = 3.4–4.2) to 2.2 (95% CI = 1.8–2.5) after the introduction of the OST policy. The fall in rates (1.6 per 1000; 95% CI = 1.0–2.2) was highly statistically significant (χ^2 on 1 d.f. = 32.0, $P < 0.00001$), and evident in both age groups. There was a similar fall in DRD risk when it was expressed per 100 person-years in the 12-weeks post-release, the rate falling from 1.9 (95% CI = 1.6–2.1) to 1.2 (95% CI = 1.0–1.4) after the introduction of OST.

However, an analysis that focused more specifically on early drug deaths did not show such a fall. Table 3 shows that among those DRDs that occurred in the 12 weeks after release there was no appreciable change in the proportion that occurred within the first 2 weeks (57%; 95% CI = 52–63% before the introduction of OST and 56%; 95% CI = 48–64% after). The change in the percentage of early deaths was only –1% (95% CI = –11–9%).

Table 1 Drug-related deaths (DRDs) and total deaths in the 12 weeks after release from Scottish prison custody during two periods (1996–99 and 2000–02) before and two periods (2003–05 and 2006–07) after the introduction of Scotland's prison-based opioid substitution therapy (OST) policy, by age group.

Period	Age group at release						
	Combined age groups			15–34 years		35+ years	
	Qualifying releases (on a per annum basis)	DRDs/total deaths in first 12 weeks (DRD %)	DRDs in first 12 weeks per 1000 releases (95% CI)	Qualifying releases	DRDs/total deaths in first 12 weeks (DRD %)	Qualifying releases	DRDs/total deaths in first 12 weeks (DRD %)
1996–99	46 058 (11 515)	169/276 (61%)	3.7 (3.1–4.2)	37 067	146/207 (78%)	8991	23/69 (33%)
2000–02	34 142 (11 381)	136/210 (65%)	4.0 (3.3–4.7)	26 460	103/135 (76%)	7682	33/75 (44%)
2003–05	41 872 (13 957)	100/196 (51%)	2.4 (1.9–2.9)	31 137	81/114 (71%)	10 735	19/82 (23%)
2006 + 07	28 445 (16 254)	54/130 (42%)	1.9 (1.4–2.4)	20 563	37/ 69 (54%)	7882	17/61 (28%)
Totals	150 517	459/817 (56%)		115 227	367/525 (70%)	35 290	92/287 (32%)

CI = confidence interval.

Table 2 Drug-related death risk (DRD risk) in the 12 weeks after release from at least 14 days in Scottish prison custody: before (1996–2002) and after (2003–07) prison-based opioid substitution therapy (OST) was introduced.

Period	DRDs in 12 weeks post-release	Qualifying releases	DRDs in 12 weeks post-release per 1000 releases (95% CI)	Person-years at risk in 12 weeks post-release	DRD rate per 100 person-years in the 12 weeks post-release (95% CI)
Age group at release: 15–34 years					
1996–2002	249	63 527	3.9 (3.4–4.4)	12 828	1.9 (1.7–2.2)
2003–2007	118	51 700	2.3 (1.9–2.7)	9398	1.3 (1.0–1.5)
Age group at release: 35+ years					
1996–2002	56	16 673	3.4 (2.5–4.2)	3484	1.6 (1.2–2.0)
2003–2007	36	18 617	1.9 (1.3–2.6)	3558	1.0 (0.7–1.3)
Combined age groups					
1996–2002	305	80 200	3.8 (3.4–4.2)	16 312	1.9 (1.7–2.1)
2003–2007	154	70 317	2.2 (1.8–2.5)	12 956	1.2 (1.0–1.4)

CI = confidence interval.

Table 3 Percentage of 12-week drug-related deaths (DRDs) that occurred in the first 2 weeks after release: before (1996–2002) and after (2003–07) prison-based opioid substitution therapy (OST) became the health-care standard in Scottish prisons.

Period	Age group at release			
	Combined age groups		15–34 years	35+ years
	DRDs in first 2 weeks: as percentage of 12-week DRDs	95% CI for first 2 weeks percentage	DRDs in first 2 weeks: as percentage of 12-week DRDs	DRDs in first 2 weeks: as percentage of 12-week DRDs
1996–2002	175: 57% of 305	52–63%	146: 59% of 249	29: 52% of 56
2003–2007	87: 56% of 154	48–64%	70: 59% of 118	17: 47% of 36
Totals	262: 57% of 459	52–62%	216: 59% of 367	46: 50% of 92

CI = confidence interval.

These findings were similar when the analysis was re-restricted to opiate-related DRDs (Table 4), although this information was only available for the period 2000–07. For opiate-related DRDs, the reduction in the percentage of deaths occurring within 2 weeks was again –1% (95% CI = –13–11%), from 62% before the OST policy to 61% afterwards.

Table 4 Percentage of 12-week opioid drug-related deaths (DRDs) in 2000–07 that occurred in the first 2 weeks after release: before (2000–02) and after (2003–07) prison-based opioid substitution therapy (OST) was introduced in Scottish prisons.

Period*	First 2 weeks: combined age groups	
	Opioid-DRDs in first 2 weeks: as percentage of 12-week opioid DRDs	95% CI for first 2 weeks percentage*
2000–2002	72: 62% of 117	53–70%
2003–2007	80: 61% of 132	52–69%
Totals	152: 61% of 249	55–67%

*There were four DRDs in 2000–02 and four in 2003–07 for whom toxicology could not be linked. Hence, 132/150 linked DRDs in 2003–07 (88%) and 117/132 linked DRDs in 2000–02 (86%) were opioid DRDs.

DISCUSSION

Statement of principal findings

The DRD-rate in the first 12 weeks following release fell from 3.8 per 1000 qualifying releases in 1996–2002 before the introduction of the in-prison OST policy to 2.2 per 1000 afterwards. This reduction was significant ($P < 0.01$) in both age-groups, and similar whether measured per 1000 qualifying releases or per 100 person-years at liberty. However, the percentage of these DRDs that occurred in the first 2 weeks after release did not reduce appreciably, a finding which does not support the suggestion that OST would reduce DRDs in the immediate period after release.

Strengths and weaknesses of the study

One weakness of our study was that for deaths during 1996–99 we did not have access to the post-mortem toxicology information required to classify deaths as opioid-related in accordance with the United Kingdom's harmonized DRD definition. However, for ICD-10-coded DRDs during 2000–07 the majority of DRDs soon after release were opiate-related DRDs, and so this issue is

unlikely to affect our conclusions. Further, the results of the analysis restricted to opioid-related DRDs were the same as the main analysis.

Death registration in Scotland is highly complete and timely [24]. A small number of deaths may have been missed because they occurred outside Scotland. Some deaths could have been missed because of inaccurate data linkage, but estimates based on clerical checking suggest that rates of false positive or negative linkage are below 1% [26].

We did not have information about whether individual prisoners received OST during their preceding term of imprisonment. However, as noted previously, surveys indicated high levels of usage of OST in Scottish prisons after the introduction of the policy [13,21,22]. We do not know how many releases were of opioid-dependent individuals. Unlike Degenhardt *et al.* [18], our goal was a before-and-after evaluation of the policy of prison-based OST, rather an explanatory analysis at the individual level of whether opioid-dependent prisoners benefited from in-prison OST.

A notable strength of our study is that the numbers were sufficient to provide a reasonably precise estimate of the change in the percentage of DRDs that occurred in the first 2 weeks. As noted above, the change in this percentage between 1996–2002 and 2003–07 was –1% (95% CI = –11–9%). The lower 95% confidence limit of –11% clearly excludes any substantial reduction.

Interpretation of these results

This study provides no evidence that in-prison OST was the cause of the reduced DRD risk during the first 12 weeks after release. A possible alternative explanation is that the proportion of prisoners who were opioid-dependent decreased. We cannot rule this out, but we think it unlikely, as the surveillance of Scottish prisoners' HIV-risk behaviours in 1994–96 [15,16] and by Taylor *et al.* [13] for 2010 showed that a third of Scottish prisoners had a life-time history of injection drug use. However, the proportion who reported having ever injected inside prison fell from half in the mid-1990s to only a quarter in 2010 [13]. Moreover, 57% of inmates with a history of having ever injected drugs self-reported that they were receiving methadone maintenance [13], a figure similar to that reported in NSW [18].

We cannot exclude other explanations for the decrease in DRD rate in the first 12 weeks post-release. Upturn in economic prospects could be a possible explanation but, among the poorest in Scotland, incomes started to fall from 2003 [27], the start of the OST era, which makes this an unlikely explanation.

A much more likely explanation of the observed fall in the 12-week DRD risk is the contribution of improved

quality assurance in methadone prescribing in the outside community. During 1996–2007 access to, and the safety of, methadone prescriptions in Scotland increased in the outside community [28], accompanied by a reduction in DRD risk [29–31]. Strang *et al.* [28] showed that there was a substantial reduction in methadone-related deaths in Scotland from 29 to 13 per million defined daily doses between 1996–2002 and 2003–07. More generally, Merrill [29] showed that Scottish drug treatment clients' DRD rate fell from 0.50 per 100 person-years in 1996/97–2000/01 (95% CI = 0.45–0.55) to 0.34 in 2001/02–2005/06 (95% CI = 0.30–0.38).

Thus, better quality-assurance in how methadone was prescribed in Scotland outside its prisons and better community access to drug treatment may have contributed to the observed decrease in DRD rate in the first 12 weeks after qualifying releases in 2003–07. However, the increased risk of DRD in the first 2 weeks (that is, the proportion of 12-week DRDs occurring in the first 2 weeks) is unlikely to be affected by these trends.

DRDs formed a larger percentage of deaths in the first 12 weeks among younger compared to older prisoners. However, our results do not support the suggestion that OST is more effective among younger than older prisoners.

The percentage reduction in DRD risk was similar whether calculated per 1000 qualifying releases or per 100 person-years at liberty [2]. The latter is theoretically preferable because follow-up time is taken into account but, in practice, is unavailable in jurisdictions which cannot track individuals' re-incarceration, which we did. Our results support the recommendation by Bird & Hutchinson [2] that reliable conclusions can be drawn on the basis of 2- and 12-week DRD rates per 1000 qualifying releases when person-years at risk are not available.

Setting our results in context of the literature

No previous national study has quantified the impact of the policy of prison-based OST on drug-related deaths within 12 weeks after prison release or on the percentage of those deaths that occur in the first 2 weeks after release. A time-series analysis of prison-based OST at Leeds prison focused on in-prison opioid-related deaths and on prisoners' preference for OST over detoxification [32]. Degenhardt *et al.* [18] concluded that the provision of OST in prison to opiate-dependent prisoners had a short-term protective effect post-release, which decayed quickly. Prisoners who actually received prison-based OST experienced a substantial reduction in the hazard of in-prison death (approximately 0.16 per 100 person-years) [11]. In NSW, as in Scotland, DRDs in the first 2 weeks after prison release were three times more frequent than suicides in prison [2,11,18], and so a reduction in DRDs

after release could have a greater impact in saving more lives.

Policy implications

In Scotland, three-quarters of DRDs are opioid-related. The total number of DRDs increased by 30% from 288 per annum in 1996–2002 to 377 in 2003–2007 [33]. However, outside the prison setting, DRD rates for Scotland's drug treatment clients have decreased by approximately 30% [29,30], in accordance with OST's general protective effect against DRDs [31], from which ex-prisoners might also be expected to benefit.

Our finding that ex-prisoners' DRD rate in the 12 weeks post-release decreased substantially, coincident with the introduction of OST in Scottish prisons, is a welcome finding, even if it is unlikely to be directly attributable to prison-based OST. Parity in OST provision with the outside community is the primary reason that opioid-dependent prisoners should have access to methadone maintenance [20], and was one reason for its adoption in Scottish prisons. OST took longer to implement in England and Wales [32,34] than in Scotland, and its introduction in Canada was controversial [35]. Neither in Taiwan [36] nor in the United States [37,38] is OST in prisons an accepted policy, despite community access.

Our results indicate that prison-based OST is unlikely to reduce the very high DRD risk in the first 2 weeks after prison release. This requires further consideration of the reduced tolerance for opioids during imprisonment, on one hand, and high-risk behaviours after release on the other hand. Newly liberated ex-prisoners may be at greater risk than other opioid-users of relapse into more hazardous use of heroin [39], such as by injection or in combination with other respiratory suppressants such as alcohol or benzodiazepines. Reductions in early DRDs may depend upon the released prisoner engaging with community-based OST [11] and may require more specifically targeted interventions at the time of release, such as naloxone-on-release [2,40–42]. Despite our findings, provision of OST in prisons is fully justified on grounds of parity of health-care and by its contribution to reduction of in-prison deaths including suicide [11,12] and of injecting in prison [13–15,17].

A substantial reduction in the proportion of 12-week DRDs occurring in the first 2 weeks after prison-release was not supported by our data. None the less, we encourage other prison jurisdictions to undertake similar before-and-after evaluations of their prison-based OST policy to provide a more definitive answer than can any single jurisdiction on whether a more modest OST-related decrease might apply; for instance, 15% or from 60 to 51%, with which our data are consistent. Future research

might also aim to collect information on whether individual prisoners received OST in prison to enable both an evaluation of prisons' OST-policy and its uptake by inmates.

Declaration of interests

As then Director of Health and Care at Scottish Prison Service, A.E. was responsible for the introduction of methadone maintenance therapy from 2003 in Scottish prisons. S.M.B. is a statistician-member of Scotland's National Naloxone Advisory Group and is co-grant-holder (with M. K. B. Parmar and J. Strang) for the MRC-funded prison-based pilot N-ALIVE Trial of naloxone-on-release. S.M.B. holds GSK shares.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site.

Appendix S1 Codes according to World Health Organisation's International Classification of Disease version 9 (ICD9) and version 10 (ICD10); as used in analyses.